Chapter 4.4.17: Noise

4.4.17-1 INTRODUCTION

This chapter assesses the potential noise effects of the Project once completed. The Preferred Alternative would result in small changes to the horizontal alignment of the Norfolk Southern railroad right-of-way as it passes through Letchworth State Park and over the Genesee River. The Preferred Alternative would allow trains to operate at higher speeds across the Portageville Bridge (35 MPH rather than 10 MPH), which could increase noise levels but would reduce the duration of each train pass-by. No changes to the length of trains or to the number of trains are proposed as a result of the Project. Thus, this chapter evaluates the effects on noise levels of the increased train speed across a new Portageville Bridge.

Potential noise and vibration impacts during construction are discussed in Chapter 4.5, “Construction Effects.”

There is a potential that the number of trains will increase on the Southern Tier route independent of the Project. A discussion of the longer-term effects that may occur in the future if the number of trains on the bridge increases independent of the Portageville Bridge Project is provided in Chapter 4.7, “Cumulative Effects.”

The New York State Department of Transportation *The Environmental Manual* does not provide guidance for the analysis of noise from rail operations. The Federal Highway Administration (FHWA) *Procedures for Abatement of Highway Traffic Noise and Construction Noise* also does not provide guidance of the evaluation of noise from rail operations. Therefore, the analysis of the effects of the Project on noise was conducted following the methodology used by the Federal Transit Administration (FTA) and Federal Railroad Administration (FRA) in evaluating the noise of rail projects. This methodology is set forth in a guidance manual prepared by the FTA, *Transit Noise and Vibration Impact Assessment*, FTA-VA-90-1003-06, May 2006. The methodology that was used for the analysis conducted is described in this chapter.

4.4.17-2 METHODOLOGY

4.4.17-2-1 Noise Fundamentals, Standards, and Impact Criteria

Airborne Noise Fundamentals

Quantitative information on the effects of airborne noise on people is well documented. If sufficiently loud, noise may adversely affect people in several ways. For example, noise may interfere with human activities, such as sleep, speech communication, and tasks requiring concentration or coordination. It may also cause annoyance, hearing damage, and other physiological problems. Several noise scales and rating methods are used to quantify the effects of noise on people. These scales and methods consider such factors as loudness, duration, time of occurrence, and changes in noise level with time. However, most of the stated effects of noise on people are subjective.

Sound pressure levels are measured in units called “decibels” (dB). The particular character of the noise that we hear (a whistle compared with a French horn, for example) is determined by the rate, or "frequency," at which the air pressure fluctuates, or "oscillates." Frequency defines the oscillation of sound pressure in terms of cycles per second. One cycle per second is known as 1 Hertz (Hz). People can hear over a relatively limited range of sound frequencies, generally between 20 Hz and 20,000 Hz, and the human ear does not perceive all frequencies equally well. High frequencies (the whistle, for example) are more easily discerned and therefore more intrusive than many of the lower frequencies (the lower notes on the French horn, for example).

"A"-Weighted Sound Level (dBA)

To provide a uniform noise measurement that simulates people's perception of loudness and annoyance, the decibel measurement is weighted to account for those frequencies most audible to the human ear. This is known as the A-weighted sound level, or "dBA," and it is the most often used descriptor of noise levels where community noise is the issue. As shown in **Table 4.4.17-1**, the threshold of human hearing is defined as 0 dBA; very quiet conditions (as in a library, for example) are approximately 40 dBA; levels between 50 dBA and 70 dBA define the range of acceptable-daily activity; levels above 70 dBA would be considered noisy, and then loud, intrusive, and deafening as the scale approaches 130 dBA. For most people to perceive an increase in noise, it must be at least 3 dBA. At 5 dBA, the change will be readily noticeable (Bolt, Beranek and Newman, 1973). An increase of 10 dBA is generally perceived as a doubling of loudness.

It is also important to understand that combinations of different sources are not additive in an arithmetic manner, because of the dBA scale's logarithmic nature. For example, two noise sources—a vacuum cleaner operating at approximately 72 dBA and a telephone ringing at approximately 58 dBA—do not combine to create a noise level of 130 dBA, the equivalent of a jet airplane or air raid siren (see **Table 4.4.17-1**). In fact, the noise produced by the telephone ringing may be masked by the noise of the vacuum cleaner and not be heard. The logarithmic combination of these two noise sources would yield a noise level of 72.2 dBA.

Effects of Distance on Noise

Noise varies with distance. For example, highway traffic 50 feet away from a receptor (such as a person listening to the noise) typically produces sound levels of approximately 70 dBA. The same highway noise measures 66 dBA at a distance of 100 feet, assuming soft ground conditions. This decrease is known as "drop-off." The outdoor drop-off rate for line sources, such as traffic, is a decrease of approximately 4.5 dBA (for soft ground) for every doubling of distance between the noise source and receptor (for hard ground the outdoor drop-off rate is 3 dBA for line sources). Assuming soft ground, for point sources, such as amplified rock music, the outdoor drop-off rate is a decrease of approximately 7.5 dBA for every doubling of distance between the noise source and receptor (for hard ground the outdoor drop-off rate is 6 dBA for point sources).

Noise Descriptors Used in Impact Assessment

The sound-pressure level unit of dBA describes a noise level at just one moment but since very few noises are constant, other ways of describing noise over more extended periods have been developed. One way of describing fluctuating sound is to describe the fluctuating noise heard over a specific period as if it were a steady, unchanging sound (i.e., as if it were averaged over that time period). For this condition, a descriptor called the "equivalent sound level," L_{eq} can be computed. L_{eq} is the constant sound level that, in a given situation and period (e.g., 1 hour, denoted by $L_{eq(1)}$, or 24 hours, denoted as $L_{eq(24)}$), conveys the same sound energy as the actual time-varying sound.

Table 4.4.17-1
Common Noise Levels

Sound Source	(dBA)
Military jet, air raid siren	130
Amplified rock music	110
Jet takeoff at 500 meters	100
Freight train at 30 meters	95
Train horn at 30 meters	90
Heavy truck at 15 meters	
Busy city street, loud shout	80
Busy traffic intersection	
Highway traffic at 15 meters, train	70
Predominantly industrial area	60
Light car traffic at 15 meters, city or commercial areas or residential areas close to industry	
Background noise in an office	50
Suburban areas with medium density transportation	
Public library	40
Soft whisper at 5 meters	30
Threshold of hearing	0

Note: A 10 dBA increase in level appears to double the loudness, and a 10 dBA decrease halves the apparent loudness.

Source: Cowan, James P. Handbook of Environmental Acoustics. Van Nostrand Reinhold, New York, 1994. Egan, M. David, Architectural Acoustics. McGraw-Hill Book Company, 1988.

A descriptor for cumulative 24-hour exposure is the day-night sound level, abbreviated as L_{dn}. This is a 24-hour measure that accounts for the moment-to-moment fluctuations in A-weighted noise levels due to all sound sources during 24 hours, combined. Mathematically, the L_{dn} noise level is the energy average of all $L_{eq(1)}$ noise levels over a 24-hour period, where nighttime noise levels (10 PM to 7 AM) are increased by 10 dBA before averaging.

Following FTA guidance, either the maximum $L_{eq(1)}$ sound level or the L_{dn} sound level is used for impact assessment, depending on the type of land use, as described below.

Airborne Noise Standards and Criteria

The FTA guidance manual defines noise criteria based on the specific type of land use that would be affected, with explicit operational noise impact criteria for three land use categories. These impact criteria are based on either peak 1-hour L_{eq} or 24-hour L_{dn} values. **Table 4.4.17-2** describes the land use categories defined in the FTA manual, and provides noise metrics used for determining operational noise impacts. As shown in the table, Categories 1 and 3—which include land uses that are noise-sensitive, but where people do not sleep—require examination using the 1-hour L_{eq} descriptor for the noisiest peak hour. Category 2, which includes residences, hospitals, and other locations where nighttime sensitivity to noise is very important, requires examination using the 24-hour L_{dn} descriptor.

Table 4.4.17-2
Land Use Category and Metrics for Rail Noise Impact Criteria

Noise Land Use Category	Noise Metric (dBA)	Description of Land Use Category
1	Outdoor $L_{eq(h)}$*	Tracts of land where quiet is an essential element in the intended purpose. This category includes lands set aside for serenity and quiet, and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included are recording studios and concert halls.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels, where a nighttime sensitivity to noise is assumed to be of utmost importance.
3	Outdoor $L_{eq(h)}$*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for study or meditation associated with cemeteries, monuments, museums, campgrounds and recreational facilities can also be considered to be in this category. Certain historical sites and parks are also included.

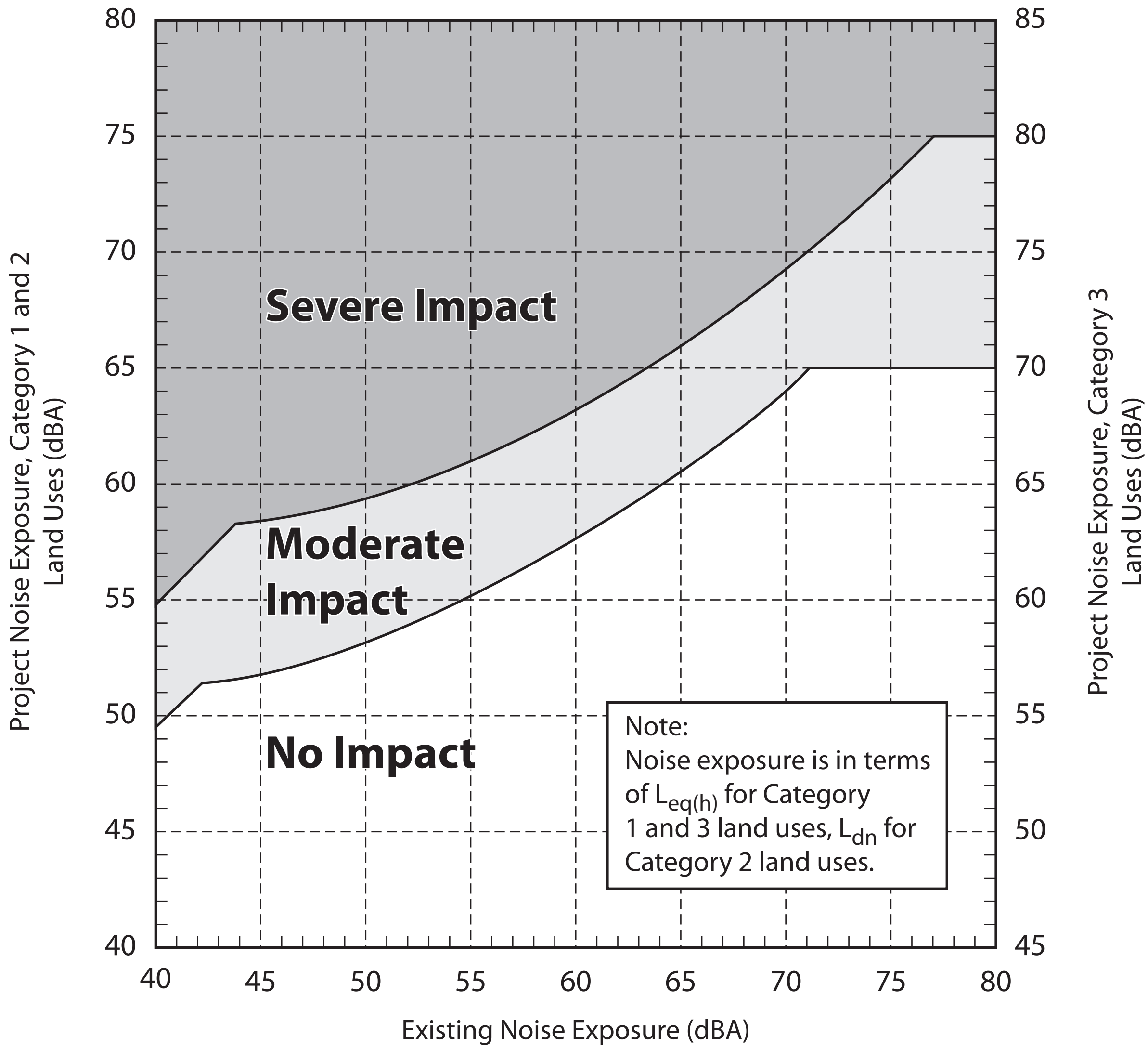
Note: * L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.
Source: *Transit Noise and Vibration Impact Assessment*, FTA, FTA-VA-90-1003-06, May 2006.

The criteria used to identify when a rail project causes an airborne noise impact are based on land use category, the existing noise level, and the noise level generated by the project (called “project noise exposure”). **Figure 4.4.17-1** shows FTA’s noise impact criteria for rail projects. Two types of impacts—moderate and severe—are defined for each land use category, depending on existing noise levels. The difference between “severe impact” and “moderate impact” is that a severe impact occurs when a change in noise level occurs that a significant percentage of people would find annoying, while a moderate impact occurs when a change in noise level occurs that is noticeable to most people but not necessarily sufficient to result in strong adverse reactions from the community.

Vibration and Groundborne Noise Fundamentals

Fixed railway operations have the potential to produce high vibration levels, since railway vehicles contact a rigid steel rail with steel wheels. Train wheels rolling on the steel rails create vibration energy that is transmitted into the track support system. The amount of vibrational energy is strongly dependent on such factors as how smooth the wheels and rails are and the vehicle suspension system. The vibration of the track structure “excites” the adjacent ground, creating vibration waves that propagate through the various soil and rock strata to the foundations of nearby buildings. As the vibration propagates from the foundation through the remaining building structure, certain resonant, or natural, frequencies of various components of the building may be excited.

The effects of groundborne vibration may include discernable movement of building floors, rattling of windows, and shaking of items sitting on shelves or hanging on walls. In extreme cases, the vibration can cause damage to buildings. The vibration of floors and walls may cause perceptible vibration, rattling of such items as windows or dishes on shelves. The movement of building surfaces and objects within the building can also result in a low-frequency rumble noise. The rumble is the noise radiated from the motion of the room surfaces, even when the motion itself cannot be felt. This is called groundborne noise.



Source: Transit Noise and Vibration Impact Assessment, FTA-VA-90-1003-06, May 2006

FTA Noise Impact Criteria for Transit Projects
Figure 4.4.17-1

Vibrations consist of rapidly fluctuating motions in which there is no "net" movement. When an object vibrates, any point on the object is displaced from its initial "static" position equally in both directions so that the average of all its motion is zero. Any object can vibrate differently in three mutually independent directions: vertical, horizontal, and lateral. It is common to describe vibration levels in terms of velocity, which represents the instantaneous speed at a point on the object that is displaced. In a sense, the human body responds to an average vibration amplitude, which is usually expressed in terms of the root mean square (rms) amplitude.

All vibration levels in this document are referenced to $1x10^{-6}$ inches per second. "VdB" (referenced to $1x10^{-6}$ inches per second) is used for vibration decibels to reduce the potential for confusion with noise decibels.

Effect of Propagation Path

Vibrations are transmitted from the source to the ground, and propagate through the ground to the receptor. Soil conditions have a strong influence on the levels of groundborne vibration. Stiff soils, such as some clay and rock, can transmit vibrations over substantial distances. Sandy soils, wetlands, and groundwater tend to absorb movement and thus reduce vibration transmission. Because subsurface conditions vary widely, measurement of actual vibration conditions, or transfer mobility, at the site can be the most practical way to address the variability of propagation conditions.

Human Response to Vibration Levels

Although the perceptibility threshold for groundborne vibration is about 65 VdB, the typical threshold of human annoyance is 72 VdB. As a comparison, buses and trucks rarely create vibration that exceeds 72 VdB unless these vehicles are traversing large bumps in the road at moderate speeds. With the construction of new rail rapid transit systems in the past 20 years, considerable experience has been gained about how communities react to various levels of building vibration. This experience, combined with the available national and international standards, represents a good foundation for predicting annoyance from groundborne noise and vibration in residential areas. **Table 4.4.17-3** summarizes typical human or structural responses to various levels of vibration. Background vibration is usually well below the threshold of human perception, and is of concern only when the vibration affects very sensitive manufacturing or research equipment. Electron microscopes, high-resolution lithography equipment, recording studios, and laser and optical benches are typical of equipment that is highly sensitive to vibration.

Vibration and Groundborne Noise Standards and Criteria

The FTA criteria for environmental impact from groundborne vibration and noise are based on the maximum levels for a single event. The impact criteria as defined in the FTA guidance manual are shown in **Table 4.4.17-4**. The criteria for acceptable groundborne vibration are expressed in terms of rms velocity levels in decibels and the criteria for acceptable groundborne noise are expressed in terms of A-weighted sound level. As shown in the table, the FTA methodology provides three different impact criteria—one for "infrequent" events, when there are fewer than 30 vibration events per day; one for "occasional" events, when there are between 30 and 70 vibration events per day; and one for "frequent" events, when there are more than 70 vibration events per day. It should be noted that these impacts would occur only if a project would cause groundborne noise or vibration levels that are higher than existing vibration levels. Thus, if the vibration level for a building in Category 1 is already 70 VdB (5 VdB above the 65 VdB threshold listed in **Table 4.4.17-4**) but the proposed project would not increase that level, then the project would not result in an impact.

Table 4.4.17-3
Typical Levels of Groundborne Vibration

Human/Structural Response	Velocity Level (VdB)	Typical Sources (at 50 feet)
Threshold, minor cosmetic damage fragile buildings	100	Blasting from construction projects
		Bulldozers and other heavy tracked construction equipment
Difficulty with vibration-sensitive tasks, such as reading a video screen	90	Locomotive powered freight train
Residential annoyance, infrequent events	80	Rapid Transit Rail, upper range
		Commuter Rail, typical range
Residential annoyance, frequent events		Bus or Truck over bump
	70	Rapid Transit Rail, typical range
Limit for vibration-sensitive equipment. Approximate threshold for human perception of vibration		Bus or truck, typical
	60	Typical background vibration
	50	

Source: *Transit Noise and Vibration Impact Assessment*, FTA, FTA-VA-90-1003-06, May 2006.

Table 4.4.17-4
Vibration and GroundBorne Noise Impact Criteria for General Assessment

Vibration Land Use Category	Groundborne Vibration Impact Levels (VdB re 1 micro-inch/sec)			Groundborne Noise Impact Levels (dB re 20 micro Pascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[4]	N/A[4]	N/A[4]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Notes:
1 “Frequent Events” is defined as more than 70 vibration events of the same source per day.
2 “Occasional Events” is defined as between 30 and 70 vibration events of the same source per day.
3 “Infrequent Events” is defined as fewer than 30 vibration events of the same kind per day.
4 This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.
5 Vibration-sensitive equipment is not sensitive to groundborne noise.

The limits are specified for the three land use categories defined below:

- **Vibration Land Use Category 1: High Sensitivity**—Buildings where low ambient vibration is essential for the operations within the building, which may be well below levels associated with human annoyance. Typical land uses are vibration-sensitive research and manufacturing, hospitals, and university research operations.
- **Vibration Land Use Category 2: Residential**—This category covers all residential land uses and any buildings where people sleep, such as hotels and hospitals. No differentiation is made between different types of residential areas. This is primarily because groundborne vibration and noise are experienced indoors and building occupants have practically no means to reduce their exposure. Even in a noisy urban area, the bedrooms often will be quiet in buildings that have effective noise insulation and tightly closed windows. Hence, an occupant of a bedroom in a noisy urban area is likely to be just as sensitive to groundborne noise and vibration as someone in a quiet suburban area.
- **Vibration Land Use Category 3: Institutional**—This category includes schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment, but still have the potential for activity interference.

4.4.17-2-2 Airborne Noise Methodology

Following the methodologies set forth in the FTA manual for assessing rail noise, airborne noise impacts are analyzed using a three-step process that consists of a screening procedure, a general noise assessment, and, if appropriate, a detailed noise analysis. The screening procedure is performed first to determine whether any noise-sensitive receptors are within distances where impacts are likely to occur. A screening distance of 750 feet was used for the Portageville Bridge project. This distance is based on FTA's recommended screening distance for commuter rail lines, which would be similar to a freight railway with a locomotive. If the screening reveals that there are noise-sensitive receptors in locations where impacts are likely to occur, then a general noise assessment is performed to determine locations where noise impacts could occur. If this general assessment indicates that a potential for noise impact does exist, then a detailed noise analysis can be conducted to evaluate impacts and identify mitigation with greater precision than can be achieved with the general assessment.

For the Portageville Bridge Project, a general noise assessment was conducted to evaluate the effects of the Project on sensitive receptors within the screening distance, which include Letchworth State Park and residences along Portageville Road adjacent to the eastern rail approach to the bridge. The evaluation for the sensitive receptor in Letchworth State Park considered effects immediately adjacent to the rail right-of-way. Other locations in the park, such as the Upper and Middle Falls Picnic Area, the trails, and the campground, would experience less noise from the Project than this receptor location. The Glen Iris Inn, also located within Letchworth State Park, was also included in the analysis at the request of the New York State Office of Parks, Recreation and Historic Preservation as a separate sensitive receptor even though at approximately 2,640 feet away it is outside of the screening distance.

The general noise assessment methodology consists of determining the Project noise exposure (i.e., the noise generated by the Project) at 50 feet from the centerline of track, calculating the noise from the Project at the receptor location by adjusting for distance (from the track to the receptor location), and comparing the calculated levels with the criteria based on land use categories. In order to perform the general noise assessment, FTA's CREATE railroad noise model was used. The CREATE model is a spreadsheet tool developed as part of the noise analysis for the Chicago Region Environmental and Transportation Efficiency project. It provides a means of analyzing various types of railroads by the methodology of FTA's general noise assessment. The CREATE model calculates hourly-equivalent (L_{eq}) or day-night (L_{dn}) noise levels taking into account the type of trains and types of locomotives (freight vs. passenger, diesel vs. electric), the number of locomotives on each train and length of train, the number of trains per day, the speed of the trains, characteristics of the track, and the time of day.

4.4.17-2-3 Vibration and Groundborne Noise Analysis Methodology

The vibration analysis for the Project was also performed using the procedures described in the FTA guidance manual. To examine potential impacts during operation, the FTA guidance document (similar to the approach for assessing noise) lays out a three-step approach for the analysis of vibration and groundborne noise: a screening procedure, a general assessment methodology, and, where appropriate, a detailed analysis methodology. The screening procedure is used to determine whether any vibration-sensitive receptors are within distances where impacts are likely to occur; the general assessment methodology is used to determine locations or rail segments where there is the potential for impacts; and the detailed analysis methodology is used to predict impacts and evaluate the effectiveness of mitigation with greater precision than can be achieved with the general assessment.

The first step in the FTA vibration analysis is to determine if there is the potential for a vibration impact based on the type of project. **Table 4.4.17-5** shows screening distances for commuter rail projects, which would be similar to a freight railway with a locomotive.

Table 4.4.17-5
Screening Distances for Vibration Assessment of Commuter Railroad Projects

Vibration Land Use Category*		Distance from Right-of-Way (feet)
Category 1:	Buildings where vibration would interfere with interior operations	600
Category 2:	Residences and buildings where people normally sleep	200
Category 3:	Institutional land uses with primarily daytime use	120

Source: *Transit Noise and Vibration Impact Assessment*, FTA, FTA-VA-90-1003-06, May 2006, page 9-4.

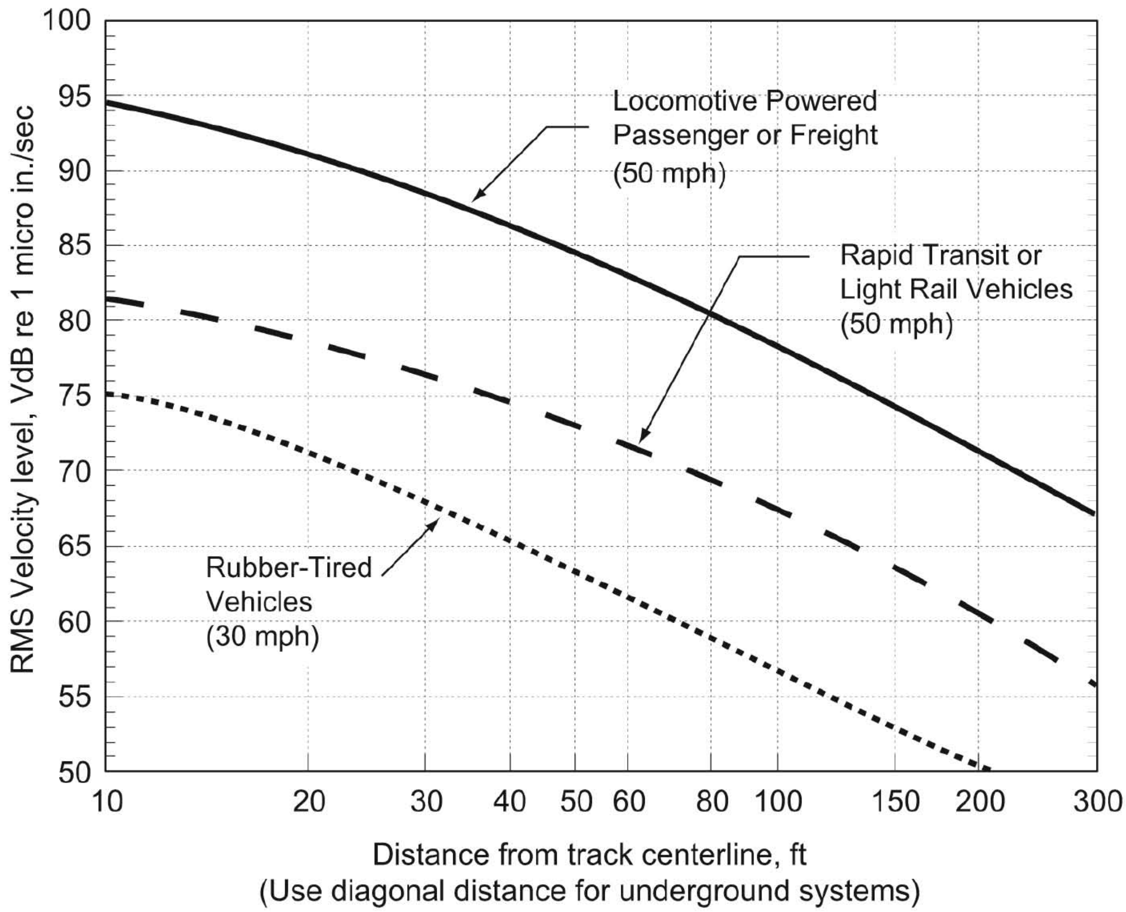
The residences along Portageville Road close to the railroad right-of-way on the east side of the rail bridge are the only vibration-sensitive uses located within the vibration-screening distances for commuter railroad set forth in the FTA manual, which is the mode most similar to freight railroad in the manual. Therefore, the potential vibration effects of the Project on that location were analyzed using the general vibration assessment procedures set forth in the FTA guidance manual.

The general vibration assessment methodology consists of determining the project vibration exposure (i.e., the vibration generated by the project) at the analysis location by use of the generalized ground surface vibration curves for various types of railroads, as shown in **Figure 4.4.17-2**. Then, adjustments are made based on the specific speed and train and track characteristics for the analyzed railroad. The resulting vibration level is then compared to the vibration criteria shown in **Table 4.4.17-4** to identify potential impacts.

4.4.17-3 EXISTING CONDITIONS

4.4.17-3-1 Airborne Noise

The locations of the noise receptor sites considered in this analysis and their land use categories are shown in **Table 4.4.17-6** and on **Figure 4.4.17-3**.

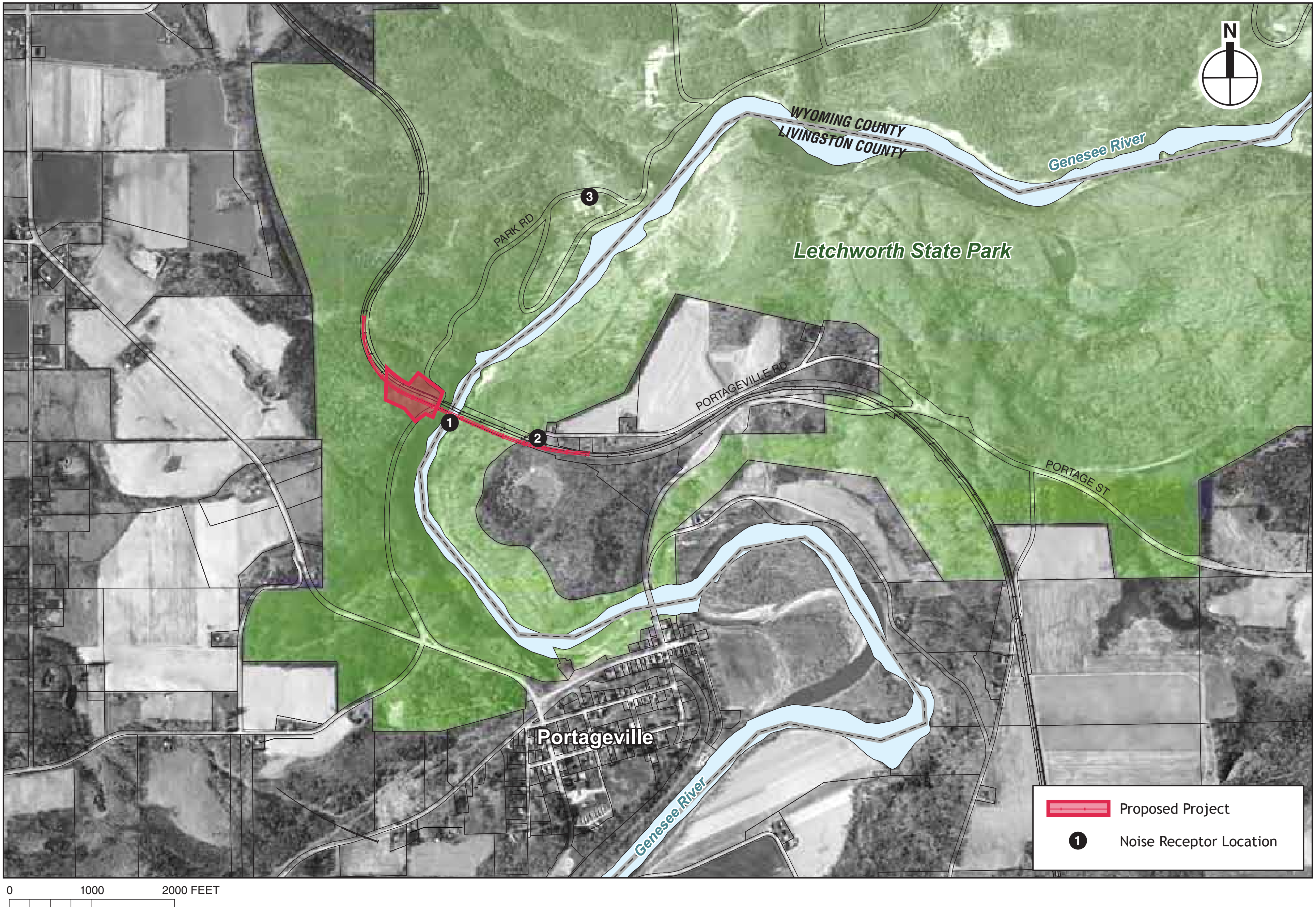


Source: Transit Noise and
Vibration Impact Assessment,
FTA-VA-90-1003-06,
May 2006

Generalized Ground Surface Vibration Curves

Figure 4.4.17-2

10.2.12



PORTAGEVILLE BRIDGE

Noise Receptor Locations
Figure 4.4.17-3

Table 4.4.17-6
Noise Receptor Sites

Site	Receptor	Distance from Rail	Noise Land Use Category
1	Letchworth State Park	50 feet	3
2	Residences at Portageville Road	130 feet	2
3	Glen Iris Inn	2,640 feet	2

Existing noise was calculated for the three receptor sites using the FTA methodology. The typical approach for a general noise assessment involves calculating noise levels taking into account the population density of an area and its proximity to interstate highways, other roadways, and rail lines. Since the dominant noise source at the three receptor locations is the existing freight rail traffic on the rail right-of-way, FTA's general noise assessment methodology for the existing rail traffic was used to estimate existing noise levels. The calculation assumed an average frequency of one train passing over the bridge every two hours throughout the day and night (a total of 14 trains per day), a speed of 10 MPH approaching and traversing the existing bridge, a train length of 2,680 feet, a single locomotive per train, no jointed track, 0.8 wheel flats per every 1,000 wheels, and embedded track on an aerial structure (for the portion of the alignment on the existing bridge). While the waterfalls near the Portageville Bridge (Upper Falls) and near the Glen Iris Inn (Middle Falls) may contribute noise at these locations that partially masks the noise of the trains, to create a conservative estimate, noise from the waterfalls was not included in this calculation.

The estimated existing noise levels are shown in **Table 4.4.17-7**.

Table 4.4.17-7
Estimated Existing Noise Levels
at Receptor Sites

Site	Location	Noise Land Use Category	Noise Metric	Existing Noise Level
1	Letchworth State Park (within 50 feet of the railroad right-of-way)	3	Outdoor $L_{eq(1)}$	66 dBA
2	Residences at Portageville Road	2	Outdoor L_{dn}	59 dBA
3	Glen Iris Inn	2	Outdoor L_{dn}	46 dBA

4.4.17-3-2 Vibration and Groundborne Noise

The analysis of vibration and groundborne noise does not involve an assessment of existing vibration and groundborne noise levels.

4.4.17-4 EFFECTS ASSESSMENT

4.4.17-4-1 No Action Alternative

In the No Action Alternative, train traffic will remain at its current level and speed on the existing bridge, resulting in no change in noise or vibration levels over the existing conditions.

4.4.17-4-2 Preferred Alternative

Airborne Noise Effects

With the Preferred Alternative, the existing rail bridge would be replaced by a new bridge located 75 feet to the south, and train speeds would increase from 10 MPH to 35 MPH approaching and traversing the bridge. Otherwise the train assumptions are the same as those for the existing conditions and the No Action Alternative (a total of 14 trains per day and the other assumptions described above). The total noise levels with the Preferred Alternative in place were estimated for the three receptor sites using the same general noise assessment procedures followed to estimate existing conditions, but with the changed assumptions about the location of the alignment and the train speed. The Project-generated noise (i.e., the Project noise exposure) was calculated as the logarithmic difference between the future noise levels with the Preferred Alternative and the existing noise levels at each receptor site. The total future noise levels are shown in the table to provide a sense of the noise conditions that would occur in the future with the Preferred Alternative in comparison to existing noise levels.

Next, the Project-generated noise (Project Noise Exposure) at each receptor site was compared to the FTA methodology impact criteria for Project-generated noise (illustrated in **Figure 4.4.17-1**, above). As noted earlier, the impact criteria are established based on existing noise levels.

Table 4.4.17-8
Noise Impact Evaluation of the Preferred Alternative (in dBA)

Site	Noise Land Use Category	Noise Descriptor	Existing Noise Level	Impact Criteria: Project-Generated Noise Threshold at Which an Impact Would Occur*		Noise Generated by Project (Project Noise Exposure)	Impact?	Total Future Noise Level with Project
				Moderate Impact	Severe Impact			
1 (Letchworth State Park)	3	$L_{eq(1)}$ (Peak)	66	67	72	68	Moderate Impact	70
2 Residences	2	L_{dn} (24-hour)	59	57	63	60	Moderate Impact	63
3 Glen Iris Inn	2	L_{dn} (24-hour)	46	52	59	47	No Impact	50

Note: * Impact criteria are based on the existing noise level and the project-generated noise, as shown in **Figure 4.4.17-1**.

Table 4.4.17-8 shows the results of the noise impact assessment analysis at the three receptor locations for the Preferred Alternative. As shown in the table, the Preferred Alternative would not result in any noise impacts at Site 3 (Glen Iris Inn). Project-generated noise would be below the impact thresholds and total future noise levels would remain low at Site 3. Consequently, the Preferred Alternative would not result in any adverse noise impacts at Site 3.

At Site 1 (Letchworth State Park immediately adjacent to the rail right-of-way), the Preferred Alternative would result in a moderate impact according to the FTA/FRA impact criteria. The resulting future $L_{eq(1)}$ noise level would be 4 dBA higher than the existing level. Noise level increases of this magnitude would be in the range of perceptibility, but would not necessarily be readily noticeable. Furthermore, the exceedance of the moderate impact threshold would be low (by 1 dBA), and the area affected would be only a small portion of the park that is immediately adjacent to the proposed new bridge. As noted above, according to the FTA/FRA noise impact thresholds, moderate impacts are changes in noise levels that are noticeable to most people but not large enough to be considered annoying.

At Site 2 (residences along Portageville Road adjacent to the rail right-of-way), the Preferred Alternative would also result in a moderate impact. The Project-generated noise would exceed the threshold for a moderate impact by 3 dBA. The resulting future L_{dn} noise level would be 4 dBA higher than the existing level. Noise level increases of this magnitude would be in the range of perceptibility, but would not necessarily be readily noticeable. Furthermore, the exceedance of the moderate impact threshold would be low.

Vibration Effects

Vibration levels resulting from the new rail bridge and change to train operations under the Preferred Alternative were calculated for Site 2 (the residences on Portageville Road near the bridge approach) using the general vibration assessment methodology previously described. The same assumptions about changes to train speed were made as for the noise analysis discussed above. **Table 4.4.17-9** shows the results of the general vibration assessment.

Table 4.4.17-9
Vibration Impact Evaluation of the Preferred Alternative

Site	Vibration Land Use Category	Distance from Track Center Line (feet)	Reference Vibration Level for Locomotive Powered Freight at 50 MPH (VdB)	Speed Adjustment (VdB)	Resultant Vibration Level at Receptor (VdB)	Vibration Impact Criterion (VdB)	Impact
2	2	130	75	-3.1	71.9	80*	No
Note: * Impact criteria for infrequent events, i.e., less than 30 events per day.							

The vibration level resulting from trains approaching and traversing the new train bridge under the Preferred Alternative would result in a vibration level less than the vibration impact criterion. Consequently, the Preferred Alternative would not have the potential to result in an adverse vibration impact.

4.4.17-5 SUMMARY OF MITIGATION

Since the Project would not have any severe noise or vibration impact on nearby noise receptors, no mitigation is required.